# TS32MLQ64V4F

**240PIN DDR2 400 Unbuffered DIMM**
**256MB With 32Mx8 CL3**

## Description

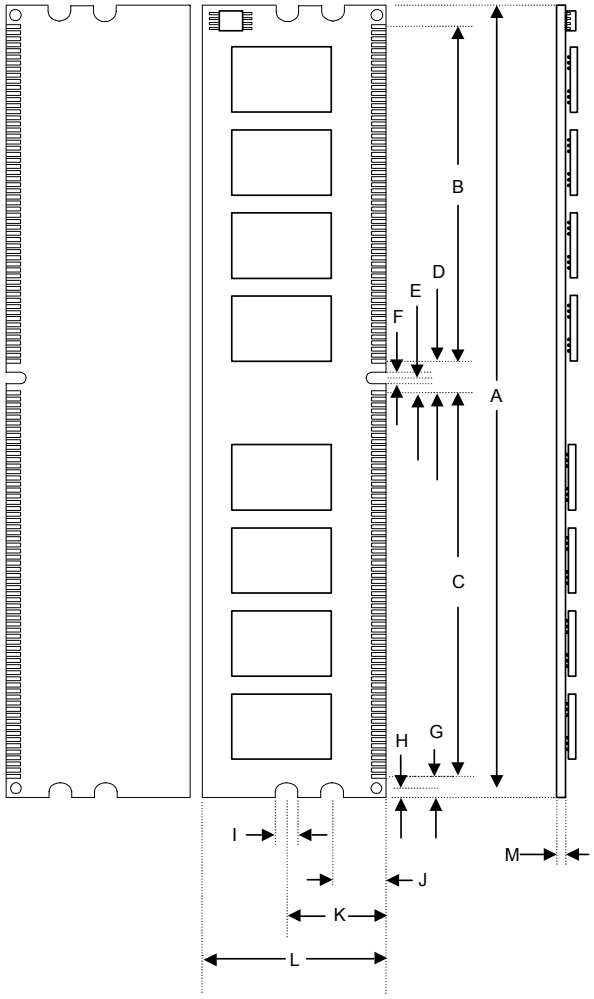
The TS32MLQ64V4F is a 32M x 64bits DDR2-400 Unbuffered DIMM. The TS32MLQ64V4F consists of 8 pcs 32Mx8bits DDR2 SDRAMs in 60 ball FBGA packages and a 2048 bits serial EEPROM on a 240-pin printed circuit board. The TS32MLQ64V4F is a Dual In-Line Memory Module and is intended for mounting into 240-pin edge connector sockets.

Synchronous design allows precise cycle control with the use of system clock. Data I/O transactions are possible on both edges of DQS. Range of operation frequencies, programmable latencies allow the same device to be useful for a variety of high bandwidth, high performance memory system applications.

## Features

- JEDEC standard 1.8V ± 0.1V Power supply
- VDDQ=1.8V ± 0.1V
- Max clock Freq: 200MHZ; 400Mb/S/Pin.
- Posted CAS
- Programmable CAS Latency: 3,4,5
- Programmable Additive Latency :0, 1,2,3 and 4
- Write Latency (WL) = Read Latency (RL)-1
- Burst Length: 4,8(Interleave/nibble sequential)
- Programmable sequential / Interleave Burst Mode
- Bi-directional Differential Data-Strobe (Single-ended data-strobe is an optional feature)
- Off-Chip Driver (OCD) Impedance Adjustment
- MRS cycle with address key programs.
- On Die Termination
- Refresh and Self Refresh
  Average Refresh Period 7.8us at lower then TCASE 85°C, 3.9us at 85°C < TCASE < 95 °C
- Serial presence detect with EEPROM

## Placement




**PCB: 09-2180**

## Dimensions

| Side | Millimeters | Inches |
|---|---|---|
| A | 133.35±0.15 | 5.250±0.006 |
| B | 55 | 2.165 |
| C | 63 | 2.480 |
| D | 5 | 0.197 |
| E | 2.5 | 0.098 |
| F | 1.5±0.10 | 0.059±0.039 |
| G | 5.175 | 0.204 |
| H | 2.2 | 0.867 |
| I | 4 | 0.157 |
| J | 10 | 0.394 |
| K | 17.8 | 0.701 |
| L | 30±0.15 | 1.181±0.006 |
| M | 1.27±0.10 | 0.050±0.004 |

**(Refer Placement)**

## Pin Identification

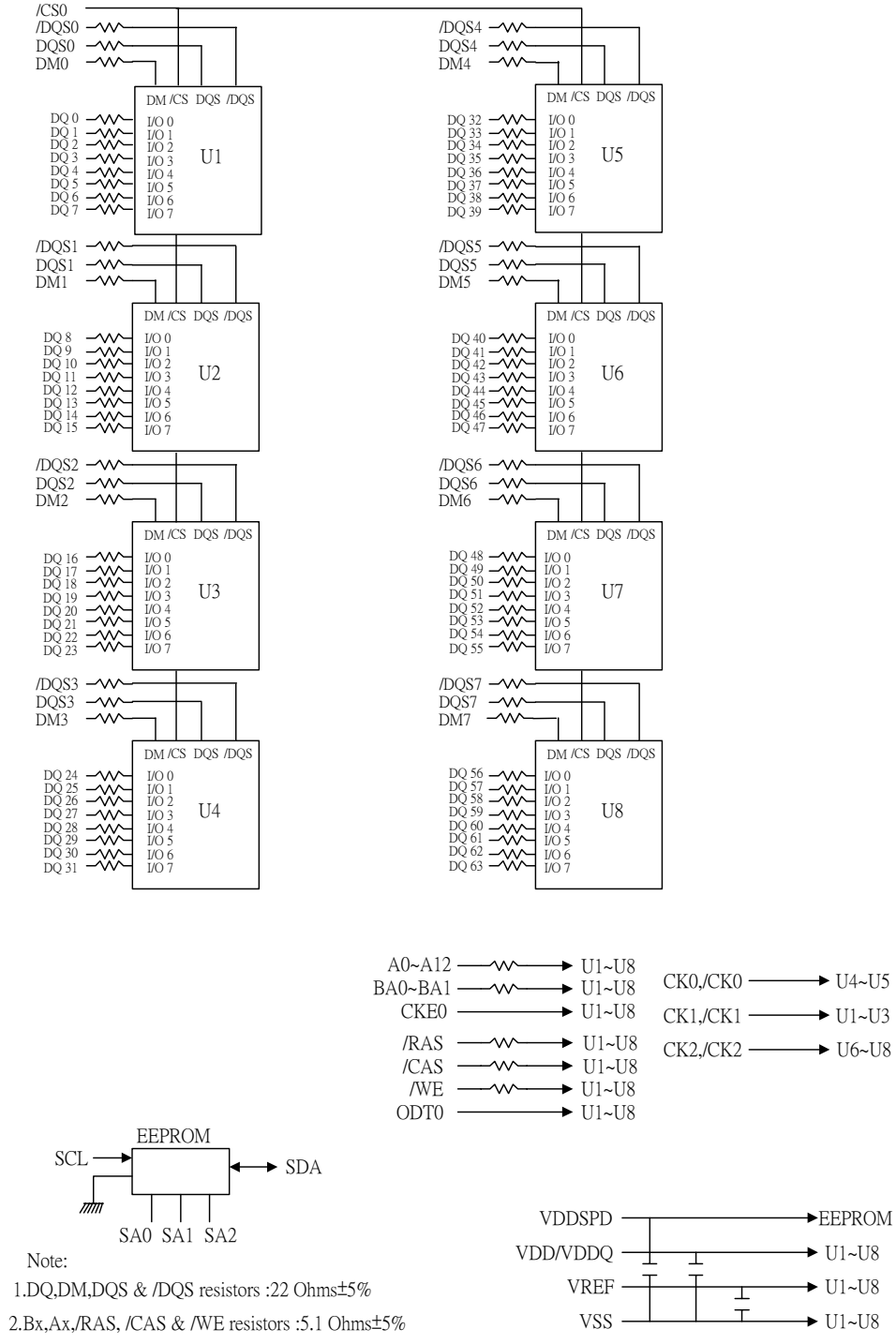
| Symbol | Function |
|---|---|
| A0~A12, BA0, BA1 | Address input |
| DQ0~DQ63 | Data Input / Output. |
| DQS0~DQS7 | Data strobe |
| /DQS0~/DQS7 | Differential Data strobe |
| CK0, /CK0<br>CK1, /CK1<br>CK2, /CK2 | Clock Input. |
| CKE0 | Clock Enable Input. |
| ODT0 | On-die termination control line |
| /CS0 | Chip Select Input. |
| /RAS | Row Address Strobe |
| /CAS | Column Address Strobe |
| /WE | Write Enable |
| DM0~DM7 | Data-in Mask |
| VDD | +1.8 Voltage power supply |
| VDDQ | +1.8 Voltage Power Supply for DQS |
| VREF | Power Supply for Reference |
| VDDSPD | Serial EEPROM Positive Power Supply |
| SA0~SA2 | Address select for EEPROM |
| SCL | Serial PD Clock |
| SDA | Serial PD Add/Data input/output |
| VSS | Ground |
| NC | No Connection |

**Pinouts:**

| Pin No | Pin Name | Pin No | Pin Name | Pin No | Pin Name | Pin No | Pin Name | Pin No | Pin Name | Pin No | Pin Name |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | VREF | 41 | VSS | 81 | DQ33 | 121 | VSS | 161 | *CB4 | 201 | VSS |
| 02 | VSS | 42 | *CB0 | 82 | VSS | 122 | DQ4 | 162 | *CB5 | 202 | DM4 |
| 03 | DQ0 | 43 | *CB1 | 83 | /DQS4 | 123 | DQ5 | 163 | VSS | 203 | NC |
| 04 | DQ1 | 44 | VSS | 84 | DQS4 | 124 | VSS | 164 | *DM8 | 204 | VSS |
| 05 | VSS | 45 | */DQS8 | 85 | VSS | 125 | DM0 | 165 | NC | 205 | DQ38 |
| 06 | /DQS0 | 46 | *DQS8 | 86 | DQ34 | 126 | NC | 166 | VSS | 206 | DQ39 |
| 07 | DQS0 | 47 | VSS | 87 | DQ35 | 127 | VSS | 167 | CB6 | 207 | VSS |
| 08 | VSS | 48 | *CB2 | 88 | VSS | 128 | DQ6 | 168 | CB7 | 208 | DQ44 |
| 09 | DQ2 | 49 | *CB3 | 89 | DQ40 | 129 | DQ7 | 169 | VSS | 209 | DQ45 |
| 10 | DQ3 | 50 | VSS | 90 | DQ41 | 130 | VSS | 170 | VDDQ | 210 | VSS |
| 11 | VSS | 51 | VDDQ | 91 | VSS | 131 | DQ12 | 171 | CKE1 | 211 | DM5 |
| 12 | DQ8 | 52 | CKE0 | 92 | /DQS5 | 132 | DQ13 | 172 | VDD | 212 | NC |
| 13 | DQ9 | 53 | VDD | 93 | DQS5 | 133 | VSS | 173 | NC | 213 | VSS |
| 14 | VSS | 54 | NC | 94 | VSS | 134 | DM1 | 174 | NC | 214 | DQ46 |
| 15 | /DQS1 | 55 | NC | 95 | DQ42 | 135 | NC | 175 | VDDQ | 215 | DQ47 |
| 16 | DQS1 | 56 | VDDQ | 96 | DQ43 | 136 | VSS | 176 | A12 | 216 | VSS |
| 17 | VSS | 57 | A11 | 97 | VSS | 137 | CK1 | 177 | A9 | 217 | DQ52 |
| 18 | NC | 58 | A7 | 98 | DQ48 | 138 | /CK1 | 178 | VDD | 218 | DQ53 |
| 19 | NC | 59 | VDD | 99 | DQ49 | 139 | VSS | 179 | A8 | 219 | VSS |
| 20 | VSS | 60 | A5 | 100 | VSS | 140 | DQ14 | 180 | A6 | 220 | CK2 |
| 21 | DQ10 | 61 | A4 | 101 | SA2 | 141 | DQ15 | 181 | VDDQ | 221 | /CK2 |
| 22 | DQ11 | 62 | VDDQ | 102 | NC | 142 | VSS | 182 | A3 | 222 | VSS |
| 23 | VSS | 63 | A2 | 103 | VSS | 143 | DQ20 | 183 | A1 | 223 | DM6 |
| 24 | DQ16 | 64 | VDD | 104 | /DQS6 | 144 | DQ21 | 184 | VDD | 224 | NC |
| 25 | DQ17 | 65 | VSS | 105 | DQS6 | 145 | VSS | 185 | CK0 | 225 | VSS |
| 26 | VSS | 66 | VSS | 106 | VSS | 146 | DM2 | 186 | /CK0 | 226 | DQ54 |
| 27 | /DQS2 | 67 | VDD | 107 | DQ50 | 147 | NC | 187 | VDD | 227 | DQ55 |
| 28 | DQS2 | 68 | NC | 108 | DQ51 | 148 | VSS | 188 | A0 | 228 | VSS |
| 29 | VSS | 69 | VDD | 109 | VSS | 149 | DQ22 | 189 | VDD | 229 | DQ60 |
| 30 | DQ18 | 70 | A10/AP | 110 | DQ56 | 150 | DQ23 | 190 | BA1 | 230 | DQ61 |
| 31 | DQ19 | 71 | BA0 | 111 | DQ57 | 151 | VSS | 191 | VDDQ | 231 | VSS |
| 32 | VSS | 72 | VDDQ | 112 | VSS | 152 | DQ28 | 192 | /RAS | 232 | DM7 |
| 33 | DQ24 | 73 | /WE | 113 | /DQS7 | 153 | DQ29 | 193 | /CS0 | 233 | NC |
| 34 | DQ25 | 74 | /CAS | 114 | DQS7 | 154 | VSS | 194 | VDDQ | 234 | VSS |
| 35 | VSS | 75 | VDDQ | 115 | VSS | 155 | DM3 | 195 | ODT0 | 235 | DQ62 |
| 36 | /DQS3 | 76 | /CS1 | 116 | DQ58 | 156 | NC | 196 | A13 | 236 | DQ63 |
| 37 | DQS3 | 77 | ODT1 | 117 | DQ59 | 157 | VSS | 197 | VDD | 237 | VSS |
| 38 | VSS | 78 | VDDQ | 118 | VSS | 158 | DQ30 | 198 | VSS | 238 | VDDSPD |
| 39 | DQ26 | 79 | VSS | 119 | SDA | 159 | DQ31 | 199 | DQ36 | 239 | SA0 |
| 40 | DQ27 | 80 | DQ32 | 120 | SCL | 160 | VSS | 200 | DQ37 | 240 | SA1 |

*For ECC type; Please refer Block Diagram

## Block Diagram




Note:

1.DQ,DM,DQS & /DQS resistors :22 Ohms±5%

2.Bx,Ax,/RAS, /CAS & /WE resistors :5.1 Ohms±5%


This technical information is based on industry standard data and tests believed to be reliable. However, Transcend makes no warranties, either expressed or implied, as to its accuracy and assume no liability in connection with the use of this product. Transcend reserves the right to make changes in specifications at any time without prior notice.

## Absolute Maximum DC Ratings

| Parameter | Symbol | Value | Unit | Notes |
|---|---|---|---|---|
| Voltage on $V_{DD}$ relative to Vss | VDD | -1.0 ~ 2.3 | V | 1 |
| Voltage on $V_{DDQ}$ pin relative to Vss | VDDQ | -0.5 ~ 2.3 | V | 1 |
| Voltage on $V_{DDL}$ pin relative to Vss | VDDL | -0.5 ~ 2.3 | V | 1 |
| Voltage on any pin relative to Vss | VIN, VOUT | -0.5 ~ 2.3 | V | 1 |
| Storage temperature | $T_{STG}$ | -55~+100 | °C | 1,2 |
| Mean time between failure | MTBF | Reserved | year | |
| Temperature Humidity Burning | THB | Reserved | °C-% | |
| Temperature Cycling Test | TC | Reserved | °C | |

Note:
1.Stress greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2.Storage Temperature is the case surface temperature on the center/top side of the DRAM. For the measurement conditions, please refer to JESD51-2 standard.

## AC & DC Operating Conditions

**Recommended DC operating conditions (SSTL –1.8)**

| Parameter | Symbol | Rating | | | Unit | Notes |
|---|---|---|---|---|---|---|
| | | Min | Typ. | Max | | |
| Supply voltage | VDD | 1.7 | 1.8 | 1.9 | V | |
| Supply voltage for DLL | VDDL | 1.7 | 1.8 | 1.9 | V | 4 |
| Supply voltage for Output | VDDQ | 1.7 | 1.8 | 1.9 | V | 4 |
| I/O Reference voltage | VREF | 0.49*$V_{DDQ}$ | 0.50*VDDQ | $V_{DDQ}$/2+50mV | V | 1,2 |
| I/O Termination voltage | VTT | $V_{REF}$-0.04 | $V_{REF}$ | $V_{REF}$+0.04 | V | 3 |
| DC Input logic high | $V_{IH(DC)}$ | $V_{REF}$+0.125 | - | $V_{DDQ}$+0.3 | V | |
| DC Input logic low | $V_{IL(DC)}$ | -0.3 | - | $V_{REF}$-0.125 | V | |

Note:
There is no specific device VDD supply voltage requirement for SSTL-1.8 compliance. However under all conditions VDDQ must be less than or equal to VDD.
1.The value of VREF may be selected by the user to provide optimum noise margin in the system. Typically the value of VREF is expected to be about 0.5 x VDDQ of the transmitting device and VREF is expected to track variations in VDDQ.
2.Peak to peak AC noise on VREF may not exceed +/-2% VREF (DC).
3.VTT of transmitting device must track VREF of receiving device.
4.AC parameters are measured with VDD, VDDQ and VDDDL tied together.

## Operating Temperature Condition

| Parameter | Symbol | Rating | Unit | Note |
|---|---|---|---|---|
| Operating Temperature | TOPER | 0 to 95 | °C | 1,2,3 |

Note:
1.Operating Temperature is the case surface temperature on the center/top side of the DRAM. For the measurement conditions, please refer to JESD51.2 standard.
2. At 0 - 85°C, operation temperature range are the temperature which all DRAM specification will be supported.
3. At 85 - 95 °C operation temperature range, doubling refresh commands in frequency to a 32ms period ( tREFI=3.9 us ) is required, and to enter to self refresh mode at this temperature range, an EMRS command is required to change internal refresh rate.

## IDD Specification parameters Definition

**( IDD values are for full operating range of voltage and Temperature)**

| Parameter | | Symbol | Max. | Unit | Note |
|---|---|---|---|---|---|
| **Operating One bank Active-Precharge current;** tCK = tCK(IDD), tRC = tRC(IDD), tRAS = tRASmin(IDD); CKE is HIGH, CS\ is HIGH between valid commands; Address bus inputs are SWITCHING; Data bus inputs are SWITCHING | | IDD0 | 760 | mA | |
| **Operating One bank Active-read-Precharge current;** IOUT = 0mA; BL = 4, CL = CL(IDD), AL = 0; tCK = tCK(IDD), tRC = tRC (IDD), tRAS = tRASmin(IDD), tRCD = tRCD(IDD); CKE is HIGH, CS\ is HIGH between valid commands; Address bus inputs are SWITCHING; Data pattern is same as IDD4W | | IDD1 | 800 | mA | |
| **Precharge power-down current**; All banks idle; tCK = tCK(IDD); CKE is LOW; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING | | IDD2P | 64 | mA | |
| **Precharge quiet standby current;** All banks idle; tCK = tCK(IDD); CKE is HIGH, CS\ is HIGH; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING | | IDD2Q | 200 | mA | |
| **Precharge standby current;** All banks idle; tCK = tCK(IDD); CKE is HIGH, CS\ is HIGH; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING | | IDD2N | 240 | mA | |
| **Active power - down current;** All banks open; tCK = tCK(IDD); CKE is LOW; Other control and address bus inputs are STABLE; Data bus inputs are FLOATING | Fast PDN Exit MRS(12) = 0mA | IDD3P-F | 240 | mA | |
| | Slow PDN Exit MRS(12) = 1mA | IDD3P-S | 120 | | |
| **Active standby current;** All banks open; tCK = tCK(IDD), tRAS = tRASmax(IDD), tRP = tRP(IDD); CKE is HIGH, CS\ is HIGH between valid commands; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING | | IDD3N | 520 | mA | |
| **Operating burst read current;** All banks open, Continuous burst reads, IOUT = 0mA; BL = 4, CL = CL(IDD), AL = 0; tCK = tCK(IDD), tRAS = tRASmax(IDD), tRP = tRP(IDD); CKE is HIGH, CS\ is HIGH between valid commands; Address bus inputs are SWITCHING; Data pattern is same as IDD4W | | IDD4R | 1,040 | mA | |
| **Operating burst write current;** All banks open, Continuous burst writes; BL = 4, CL = CL(IDD), AL = 0; tCK = tCK(IDD), tRAS = tRASmax(IDD), tRP = tRP(IDD); CKE is HIGH, CS\ is HIGH between valid commands; Address bus inputs are SWITCHING; Data bus inputs are SWITCHING IDD4R | | IDD4W | 1,080 | mA | |
| **Burst Auto refresh current;** tCK = tCK(IDD); Refresh command at every tRFC(IDD) interval; CKE is HIGH, CS\ is HIGH between valid commands; Other control and address bus inputs are SWITCHING; Data bus inputs are SWITCHING | | IDD5B | 1,280 | mA | |
| **Self refresh current;** CK and CK\ at 0V; CKE ≒ 0.2V; Other control and address bus inputs are FLOATING; Data bus inputs are FLOATING | | IDD6 | 40 | mA | |
| **Operating bank interleave read current;** All bank interleaving reads, IOUT = 0mA; BL = 4, CL = CL(IDD), AL = tRCD(IDD)-1*tCK(IDD); tCK =tCK(IDD), tRC = tRC(IDD), tRRD = tRRD(IDD), tRCD = 1*tCK(IDD); CKE is HIGH, CS\ is HIGH between valid commands; Address bus inputs are STABLE during Deselects; Data pattern is same as IDD4R; Refer to the following page for detailed timing conditions | | IDD7 | 2,040 | mA | |

Note: 1. Module IDD was calculated on the basis of component IDD and can be differently measured according to DQ loading capacitor.

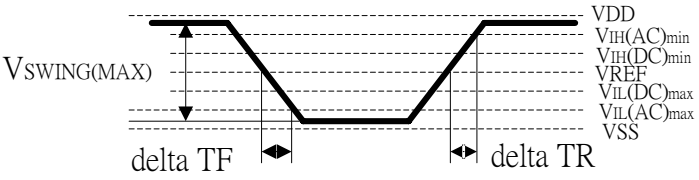
## Input AC Logic Level

| Parameter | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Input High (Logic 1) Voltage, DQ, DQS and DM signals | VIH(AC) | VREF + 0.250 | | V | |
| Input Low (Logic 0) Voltage, DQ, DQS and DM signals | VIL(AC) | | VREF - 0.250 | V | |

## AC Input Test Condition

| Condition | Symbol | Value | Unit | Note |
|---|---|---|---|---|
| Input reference voltage | VREF | 0.5*VDDQ | V | 1 |
| Input signal maximum peak to peak swing | VSWING(MAX) | 1.0 | V | 1 |
| Input signal minimum slew rate | SLEW | 1.0 | V/ns | 2,3 |

Note:
1. Input waveform timing is referenced to the input signal crossing through the VIH/IL(AC) level applied to the device under test.
2. The input signal minimum slew rate is to be maintained over the range from VREF to VIH(AC) min for rising edges and the range from VREF to VIL(AC) max for falling edges as shown in the below figure.
3. AC timings are referenced with input waveforms switching from VIL(AC) to VIH(AC) on the positive transitions and VIH(AC) to VIL(AC) on the negative transitions.




$$\text{Falling Slew} = \frac{V_{REF} - V_{IL}(AC)_{max}}{\text{delta TF}} \qquad \text{Rising Slew} = \frac{V_{IH}(AC)_{min} - V_{REF}}{\text{delta TR}}$$

AC Input Test Signal Waveform

## Input/Output Capacitance ($V_{DD}$ = 1.8V, $V_{DDQ}$ = 1.8V, $T_A$ = 25°C)

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Input capacitance (CK0 and /CK0) | CCK0 | - | 24 | pF |
| Input capacitance (CK1 and /CK1) | CCK1 | - | 25 | pF |
| Input capacitance (CK2 and /CK2) | CCK2 | - | 25 | pF |
| Input capacitance (CKE0 and /CS) | $CI_1$ | - | 42 | pF |
| Input capacitance (A0~A12, BA0~BA1, /RAS, /CAS, /WE) | $CI_2$ | - | 42 | pF |
| Input capacitance (DQ, DM, DQS, /DQS) | CIO | - | 6 | pF |

Note: DM is internally loaded to match DQ and DQS identically.

## Timing Parameters & Specifications

**(These AC characteristics were tested on the Component)**

| Parameter | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| DQ output access time from CK & /CK | tAC | -600 | +600 | ps | |
| DQS output access time from CK & /CK | tDQSCK | -500 | +500 | ps | |
| CK high-level width | tCH | 0.45 | 0.55 | tCK | |
| CK low-level width | tCL | 0.45 | 0.55 | tCK | |
| CK half period | tHP | min(tCL,tCH) | X | ps | |
| Clock cycle time, CL=x | tCK | 5000 | 8000 | ps | |
| DQ and DM input hold time | tDH | 275 | x | ps | |
| DQ and DM input setup time | tDS | 150 | X | ps | |
| Control & Address input pulse width for each input | tIPW | 0.6 | x | tCK | |
| DQ and DM input pulse width for each input | tDIPW | 0.35 | X | tCK | |
| Data-out high-impedance time from CK/CK | tHZ | X | tAC max | ps | |
| DQS low-impedance time from CK/CK | tLZ(DQS) | tAC min | tAC max | ps | |
| DQ low-impedance time from CK/CK | tLZ(DQ) | 2* tACmin | tACmax | ps | |
| DQS-DQ skew for DQS and associated DQ signals | tDQSQ | X | 350 | ps | |
| DQ hold skew factor | tQHS | X | 450 | ps | |
| DQ/DQS output hold time from DQS | tQH | tHP - tQHS | X | ps | |
| Write command to first DQS latching transition | tDQSS | WL-0.25 | WL+0.25 | tCK | |
| DQS input high pulse width | tDQSH | 0.35 | X | tCK | |
| DQS input low pulse width | tDQSL | 0.35 | X | tCK | |
| DQS falling edge to CK setup time | tDSS | 0.2 | X | tCK | |
| DQS falling edge hold time from CK | tDSH | 0.2 | X | tCK | |
| Mode register set command cycle time | tMRD | 2 | X | tCK | |
| Write postamble | tWPST | 0.4 | 0.6 | tCK | |
| Write preamble | tWPRE | 0.35 | X | tCK | |
| Address and control input hold time | tIH | 475 | X | ps | |
| Address and control input setup time | tIS | 350 | X | ps | |
| Read preamble | tRPRE | 0.9 | 1.1 | tCK | |
| Read postamble | tRPST | 0.4 | 0.6 | tCK | |
| Active to active command period for 1KB page size products | tRRD | 7.5 | X | ns | |
| Active to active command period for 2KB page size products | tRRD | 10 | X | ns | |
| Four Activate Window for 1KB page size products | tFAW | 37.5 | | ns | |

| | | | | | |
|---|---|---|---|---|---|
| Four Activate Window for 2KB page size products | tFAW | 50 | | ns | |
| /CAS to /CAS command delay | tCCD | 2 | | tCK | |
| Write recovery time | tWR | 15 | X | ns | |
| Auto precharge write recovery + precharge time | tDAL | tWR+tRP | X | tCK | |
| Internal write to read command delay | tWTR | 10 | X | ns | |
| Internal read to precharge command delay | tRTP | 7.5 | | ns | |
| Exit self refresh to a non-read command | tXSNR | tRFC + 10 | | ns | |
| Exit self refresh to a read command | tXSRD | 200 | | tCK | |
| Exit precharge power down to any non-read command | tXP | 2 | X | tCK | |
| Exit active power down to read command | tXARD | 2 | X | tCK | |
| Exit active power down to read command (Slow exit, Lower power) | tXARDS | 6 - AL | | tCK | |
| CKE minimum pulse width (high and low pulse width) | tCKE | 3 | | tCK | |
| ODT turn-on delay | tAOND | 2 | 2 | tCK | |
| ODT turn-on | tAON | tAC(min) | tAC(max)+1 | ns | |
| ODT turn-on(Power-Down mode) | tAONPD | tAC(min)+2 | 2tCK+ tAC(max)+1 | ns | |
| ODT turn-off delay | tAOFD | 2.5 | 2.5 | tCK | |
| ODT turn-off | tAOF | tAC(min) | tAC(max)+ 0.6 | ns | |
| ODT turn-off (Power-Down mode) | tAOFPD | tAC(min)+2 | 2.5tCK+ tAC(max)+1 | ns | |
| ODT to power down entry latency | tANPD | 3 | | tCK | |
| ODT power down exit latency | tAXPD | 8 | | tCK | |
| OCD drive mode output delay | tOIT | 0 | 12 | ns | |
| Minimum time clocks remains ON after CKE asynchronously drops LOW | tDelay | tIS+tCK+tIH | | ns | |

## SERIAL PRESENCE DETECT SPECIFICATION

| Serial Presence Detect | | | |
|---|---|---|---|
| Byte No. | Function Described | Standard Specification | Vendor Part |
| 0 | # of Serial PD Bytes written during module production | 128bytes | 80 |
| 1 | Total # of Bytes of S.P.D Memory Device | 256bytes | 08 |
| 2 | Fundamental Memory Type | DDR2 SDRAM | 08 |
| 3 | # of Row Addresses on this Assembly | 12 | 0D |
| 4 | # of Column Addresses on this Assembly | 10 | 0A |
| 5 | # of Module Rows on this Assembly | 2 ROW, Planar, 30.0mm | 60 |
| 6 | Data Width of this Assembly | 64bits | 40 |
| 7 | Reserved | - | 00 |
| 8 | VDDQ and Interface Standard of this Assembly | SSTL 1.8V | 05 |
| 9 | DDR2 SDRAM cycle time at Max. Supported CAS latency=X | 5.0ns | 50 |
| 10 | DDR2 SDRAM Access time from clock at CL=X | ±0.6ns | 60 |
| 11 | DIMM configuration type (non-parity, Parity, ECC) | Non parity/ECC | 00 |
| 12 | Refresh Rate | 7.8us | 02 |
| 13 | Primary DDR2 SDRAM Width | X8 | 08 |
| 14 | Error Checking DDR2 SDRAM Width | - | 00 |
| 15 | Reserved | - | 00 |
| 16 | DDR2 SDRAM device attributes: Burst lengths supported | 4,8 | 0C |
| 17 | DDR2 SDRAM device attributes: # of banks on each DDR2 SDRAM device | 4 banks | 04 |
| 18 | DDR2 SDRAM device attributes:CAS Latency supported | 5,4,3 | 38 |
| 19 | Reserved | - | 00 |
| 20 | DIMM type information | Regular UDIMM | 02 |
| 21 | DDR2 SDRAM Module Attributes | Analysis probe not installed, FET switch external not enable | 00 |
| 22 | DDR2 SDRAM Device Attributes: General | Supports weak driver | 01 |
| 23 | DDR2 SDRAM Cycle Time CL=X-1 | 5.0ns | 50 |
| 24 | DDR SDRAM Access from Clock CL=X-1 | ±0.6ns | 60 |
| 25 | DDR SDRAM Cycle Time CL=X-2 | 5.0ns | 50 |
| 26 | DDR SDRAM Access from Clock CL=X-2 | ±0.6ns | 60 |
| 27 | Minimum Row Precharge Time (tRP) | 15ns | 3C |
| 28 | Minimum Row Active to Row Activate delay (tRRD) | 7.5ns | 1E |
| 29 | Minimum RAS to CAS Delay (tRCD) | 15ns | 3C |
| 30 | Minimum active to Precharge time (tRAS) | 40ns | 28 |
| 31 | Module ROW density | 256MB | 40 |
| 32 | Command and address setup time before clock(=tIS) | 0.35ns | 35 |
| 33 | Command and address hold time after clock(=tIH) | 0.47ns | 47 |
| 34 | Data input setup time before strobe(=tDS) | 0.15ns | 15 |
| 35 | Data input hold time after strobe(=tDH) | 0.27ns | 27 |
| 36 | Write recovery time(=tWR) | 15ns | 3C |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 37 | Internal write to read command delay(=tWTR) | 10.0ns | 28 | | | | | |
| 38 | Internal read to precharge command delay(=tRTP) | 7.5ns | 1E | | | | | |
| 39 | Memory analysis probe characteristics | - | 00 | | | | | |
| 40 | Reserved | - | 00 | | | | | |
| 41 | DDR SDRAM Minimum Active to Active/Auto Refresh Time(tRC) | 55ns | 37 | | | | | |
| 42 | DDR SDRAM Minimum Auto-Refresh to Active/Auto-Refresh Command Period (tRFC) | 75ns | 4B | | | | | |
| 43 | DDR SDRAM Maximum Device Cycle Time (tCK max) | 8ns | 80 | | | | | |
| 44 | DDR SDRAM DQS-DQ Skew for DQS and associated DQ signals (tDQSQ max) | 0.35ns | 23 | | | | | |
| 45 | DDR SDRAM Read Data Hold Skew Factor (tQHS) | 0.45ns | 2D | | | | | |
| 46 | PLL Relock Time | - | 00 | | | | | |
| 47~61 | Superset Information | - | 00 | | | | | |
| 62 | SPD Data Revision Code | REV 1.0 | 10 | | | | | |
| 63 | Checksum for Bytes 0-62 | - | 4B | | | | | |
| 64-71 | Manufacturers JEDEC ID | Transcend | 7F, 4F | | | | | |
| 72 | Manufacturing Location | T | 54 | | | | | |
| 73-90 | Manufacturers Part Number | TS32MLQ64V4F | 54 | 53 | 33 | 32 | 4D | 4C |
| | | | 51 | 36 | 34 | 56 | 34 | 46 |
| | | | 20 | 20 | 20 | 20 | 20 | 20 |
| 91-92 | Revision Code | - | - | | | | | |
| 93-94 | Manufacturing Date | By Manufacturer | Variable | | | | | |
| 95-98 | Assembly Serial Number | By Manufacturer | Variable | | | | | |
| 99-127 | Manufacturer Specific Data | - | - | | | | | |
| 128~255 | Open for customer use | Undefined | - | | | | | |